REMARKS/ARGUMENTS

Claims 1-5 are pending in the Application. Reconsideration and allowance in view of the following remarks are respectfully requested.

In Paragraph 2 on page 2 of the Office Action, claims 4, 1-3 and 5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,458,202 B1 of Kojima et al. in view of JP 01040668 of Ito. This rejection is again respectfully traversed.

Claim 4 is the only independent claim in the Application. Claim 1 depends from claim 4, claims 2 and 3 each depend from claim 1, and claim 5 depends from claim 2.

The principal feature of independent claim 4 is a method for growing a semiconductor single crystal according to the Czochralski method utilizing an apparatus for producing a semiconductor single crystal, wherein the apparatus is provided with subsidiary heating means below the crucible, and after a grown single crystal is detached from the melt and taken out from the apparatus for producing a crystal, a raw material is newly added to the raw material remaining in the crucible and melted, and when a seed crystal is brought into contact with the melt to pull a single crystal again (i.e., in multi-pulling), the crucible is heated by the heater surrounding the crucible and the subsidiary heating means so that the raw material melt should not be solidified at least for a period from the point of the detachment of the single crystal ingot to the point of complete melting of the raw material in the crucible including the raw material newly added thereto.

As described at line 20 of page 20 through line 5 of page 21 of the specification, in the multi-pulling of the present invention, when the raw material is additionally introduced, if the raw material melt completely solidifies in the

crucible, a stress is applied to the crucible by the volume change at the time of solidification, and the crucible may be cracked.

However, as recited in claim 4, in the multi-pulling, when the crucible is substantially heated from below for a period from the point of the detachment of the single crystal ingot to the point of complete melting of the raw material in the crucible including the raw material newly added thereto, occurrence of solidification can be prevented, even for a small amount of melt remaining in the crucible. As a result, the raw material can be introduced at a high introduction rate, crack and deformation of the crucible can be prevented, and moreover, the amount of the melt remaining in the crucible can be made small. Therefore, a single crystal can be obtained with a high yield (see line 21 of page 12 through line 16 of page 13, and lines 6-26 of page 21, of the specification).

In the fourth paragraph on page 3 of the Office Action, it is stated with respect to claim 4 that it would have been obvious to one of ordinary skill in the art at the time of the present invention to not allow solidification of the remaining melt between batch cycles, because this would require additional heat and time to be used in re-melting the remaining raw material along with the new raw material added to the crucible for the next batch cycle. Moreover, at lines 11-13 of Paragraph 4 on page 5 of the Office Action, it is stated that the initial heating includes rapid heating of raw material just as does the replenishment step occurring after an ingot has been pulled from the crucible and more raw material is to be added before the next pulling cycle.

However, such argument is clearly made with the benefit of the hindsight afforded by the present invention. Ito teaches, as described in the Abstract thereof, that to rapidly and effectively melt the raw materials in a crucible, the raw materials are melted while independently controlling side heaters and bottom heaters. However, Ito neither teaches nor suggests the multi-pulling. Ito only

teaches that in the case of manufacturing a single crystal, the raw materials are effectively melted by using both of the side heaters and the bottom heaters after raw materials are firstly charged into the crucible as shown at the top of Fig. 3 of the reference.

However, Ito is applied to the multi-pulling. If one of ordinary skill in the art applies the development of Ito to the multi-pulling, it will be possible to melt the first raw material charge in the crucible by using both of the side heaters and the bottom heaters. However, Ito teaches that raw material is melted by use of the side heaters and the bottom heaters after the raw material is charged into the crucible. Even if the teaching of Ito is applied after pulling the first ingot, melting by the side heaters and the bottom heaters will be performed after detaching the single crystal ingot and then charging new raw material, not from the point of the detachment of the single crystal ingot from the melt as in the present invention. Ito only heats the raw material by side heaters and bottom heaters after the raw material is charged, and therefore, it is apparently with the benefit of hindsight afforded by the present invention that the heating of Ito is applied from the point of the detachment of the ingot from the crucible in the multi-pulling.

Kojima discloses in the Abstract thereof, in Fig. 3, and at lines 16-36 of column 10 that when pulling a silicon ingot by the Czochralski method, heat is applied by the side heater and the bottom heater during the second half (after about 40%-60%) of the growth process of the ingot. However, Kojima also neither discloses nor suggests the multi-pulling, much less application of heat from the point of detachment of the single crystal ingot from the melt in the multi-pulling.

As described above, Ito and Kojima neither teach nor suggest that in the multi-pulling, the crucible is heated by use of the side heater and the bottom heater for a period from the point of the detachment of the single crystal ingot to the point of complete melting of the raw material in the crucible, including the raw material

newly added thereto, as in the present invention. Therefore the invention as defined in claim 4 clearly distinguishes patentably over the attempted combination of Kojima and Ito.

Furthermore, it is apparent that claim 4 has an inventive step inasmuch as it has the advantageous effect that cracking and deformation of the crucible can be prevented and the raw material can be introduced at a high introduction rate to obtain a single crystal with a high yield.

Therefore, claim 4 is again submitted to clearly distinguish patentably over the references. Claims 1-3 and 5 depend, directly or indirectly, from claim 4 and contain all of the limitations thereof, so that such claims are also submitted to clearly distinguish patentably over the art.

In conclusion, claims 1-5 are submitted to clearly distinguish patentably over the art for the reasons described above. Therefore, reconsideration and allowance are respectfully requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6846 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
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